Introduction to Computer Graphics

Section 3 : http://bit.ly/RAVUPr

Sheet 3 : http://bit.ly/1pjPyCJ

Younies Saeed Mahmoud

younies.mahmoud@gmail.com

https://www.facebook.com/younies.mahmoud

Question 1:

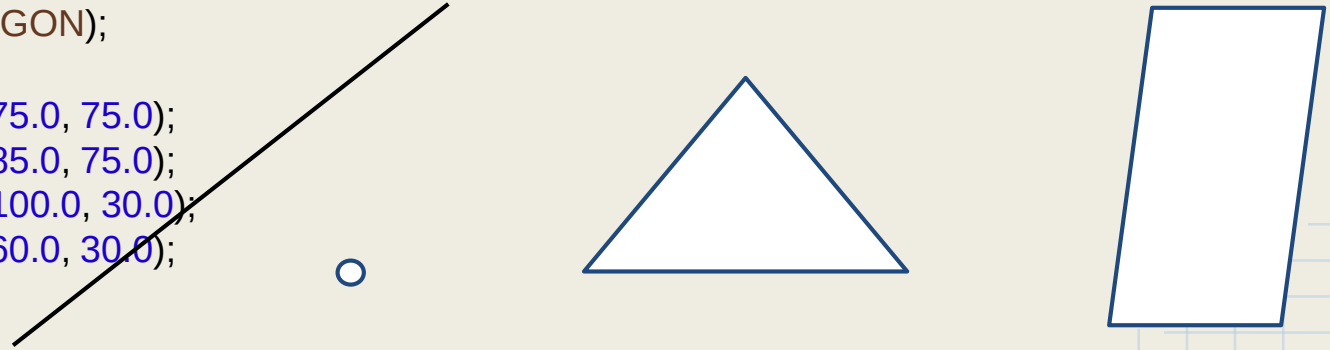
Explain with examples when possible:

- OpenGL graphics library functions can be generally classified into
  - primitive functions
  - attribute functions
  - viewing functions
  - transformation functions
  - input functions
  - control functions
  - query functions

Answer 1 :

Primitive functions:
are functions that draw primitive objects like points, lines, triangles and polygons

ex:
```
glBegin(GL_POLYGON);
        {
        glVertex2f(75.0, 75.0);
        glVertex2f(85.0, 75.0);
        glVertex2f(100.0, 30.0);
        glVertex2f(60.0, 30.0);
        }
```

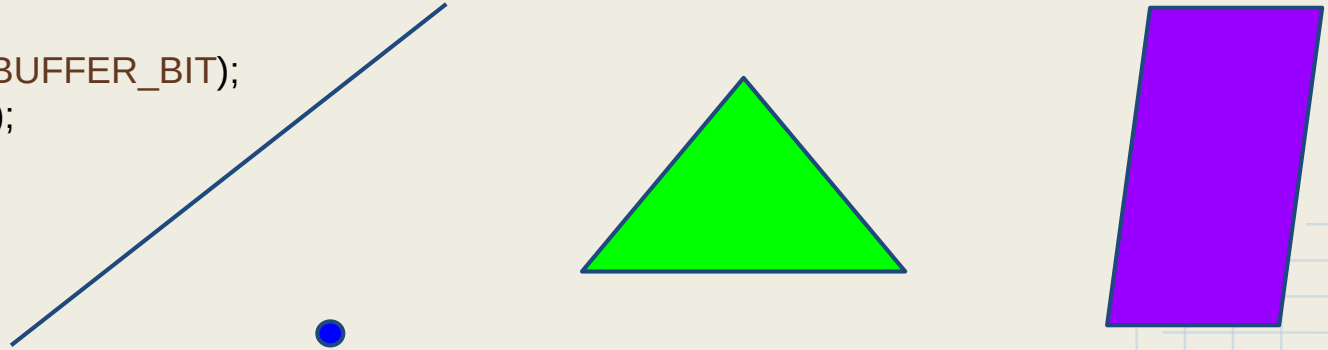


Answer 1 :

Attribute functions:
are functions that specify how the primitives are drawn. For examples, the functions that specify the current drawing color and the current clear color are examples of the attribute functions

ex:

```
glClear(GL_COLOR_BUFFER_BIT);
glColor3f(0.0, 0.0, 0.0);
```



Answer 1 :

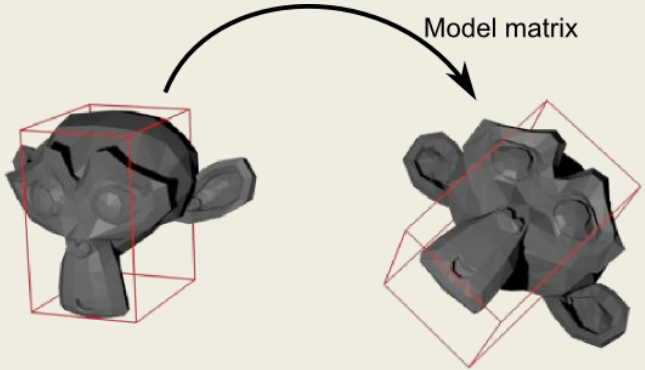
Viewing functions:
are functions that specify how the objects are viewed. They specify the location of the viewer in the world, the view direction, and the type of projection.
ex:

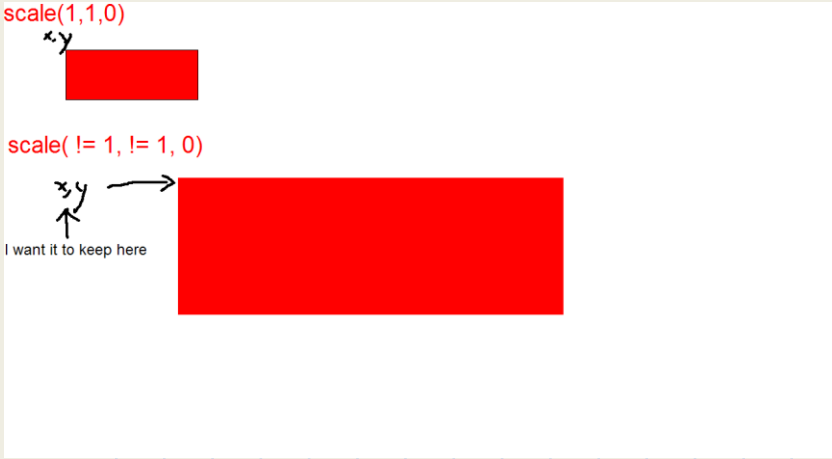
```
glViewport(0, 0, 320, 240);
gluOrtho2D(0.0, 160.0, 0.0, 120.0);
```

Answer 1 :

Transformation functions:
are functions that allow us performing transformation on object before drawing them. Examples of these transformations are

- rotation
- scaling
- translation.





Answer 1 :

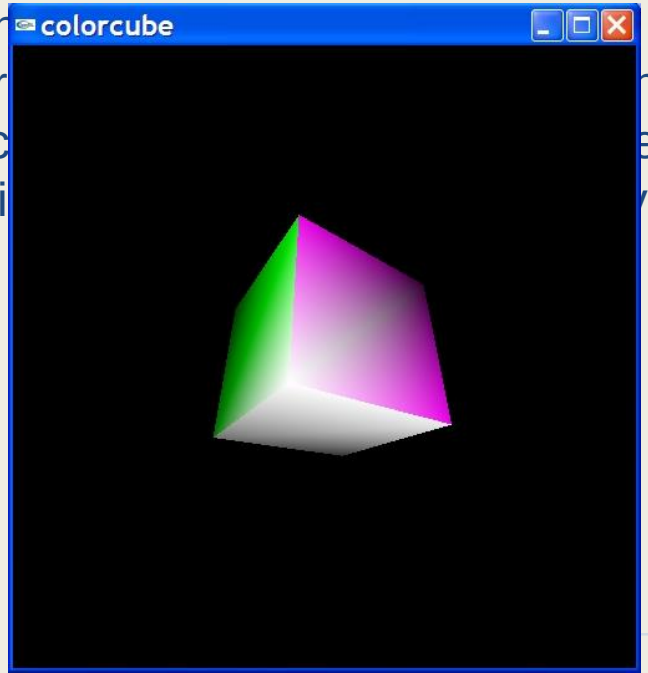
Input functions:

- are functions that allow the user to input some data to the graphics program while being executed.
- These functions are used to add interactivity to the program.
- Examples are functions that allow the user to specify a location using the mouse or input string/numeric data using the keyboard

Answer 1 :

Input functions:

- are functions that allow the user to input some data to the graphics program while bein
- These functions ar ne program.
- Examples are func ecify a location using the mouse or input stri yboard

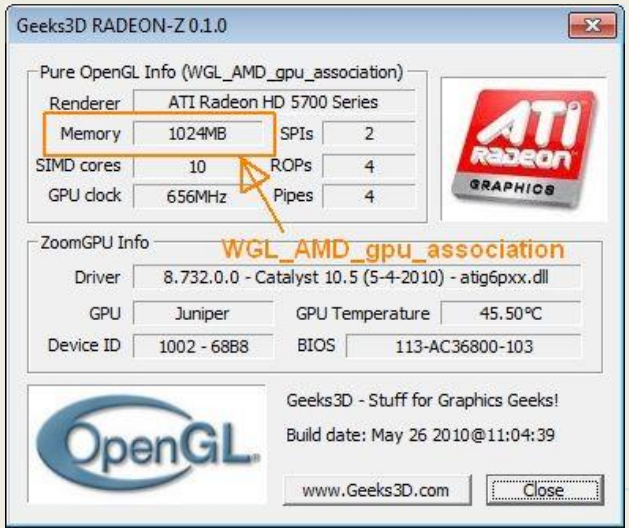


Answer 1 :

Control function:
The control functions enable users to communicate with the window system, to initialize our programs, and to deal with any errors that take place during the execution of our programs.

Answer 1 :

Query functions:
are functions that provide information about the current setting of the graphics library.



Question 2 :

OpenGL output is strictly specified and will predictable when we model our objects using simple, convex and flat polygons.

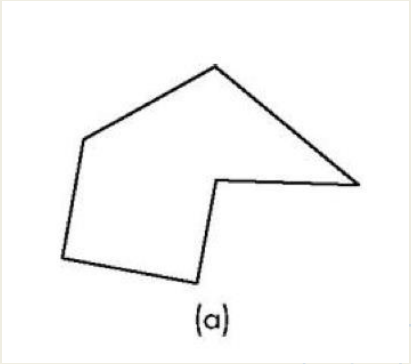
- What is a flat polygon?
- What is a simple polygon?
- What is a convex polygon?

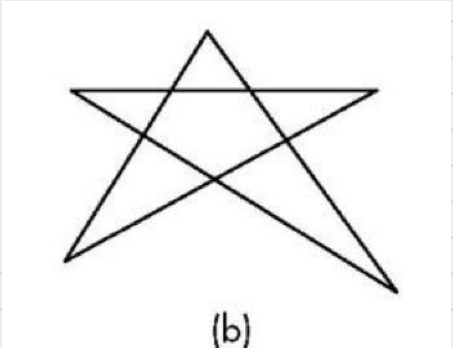
Give example in drawing when possible.

Answer 2:

Three properties will ensure that a polygon will be displayed correctly: It must be

1. **simple**
   - **as long as no two edges of a polygon cross each other, we have a simple polygon.**
   - **Testing is very complex and is left to the application program not to the gl lib.**



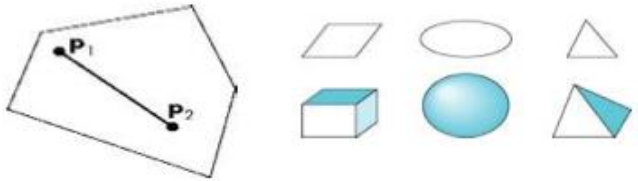


Answer 2:

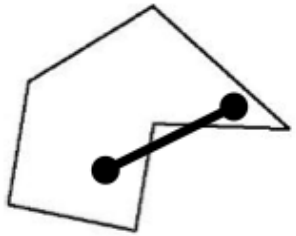
Three properties will ensure that a polygon will be displayed correctly: It must be

2. **convex**
   - An object is convex if all points on the line segment between any two points inside the object, or on its boundary, are inside the object.
   - Testing is very complex and is left to the application program not to the gl lib.

(a)



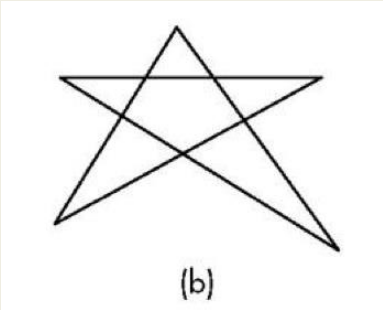
(b)

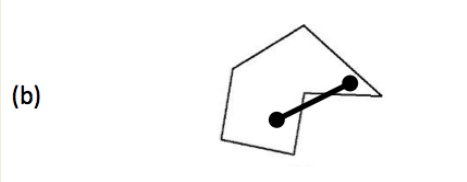


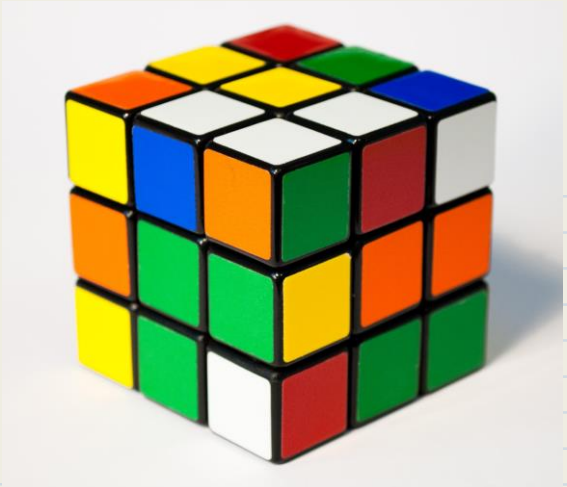
Answer 2:

Three properties will ensure that a polygon will be displayed correctly: It must be

3. **Flat**
    - The entire object lies in the same plane



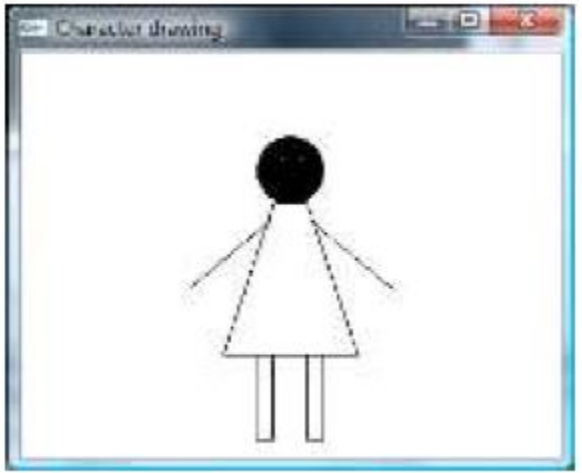




Question 3:

Write an OpenGL program to draw the following symbolic characters.

(a)

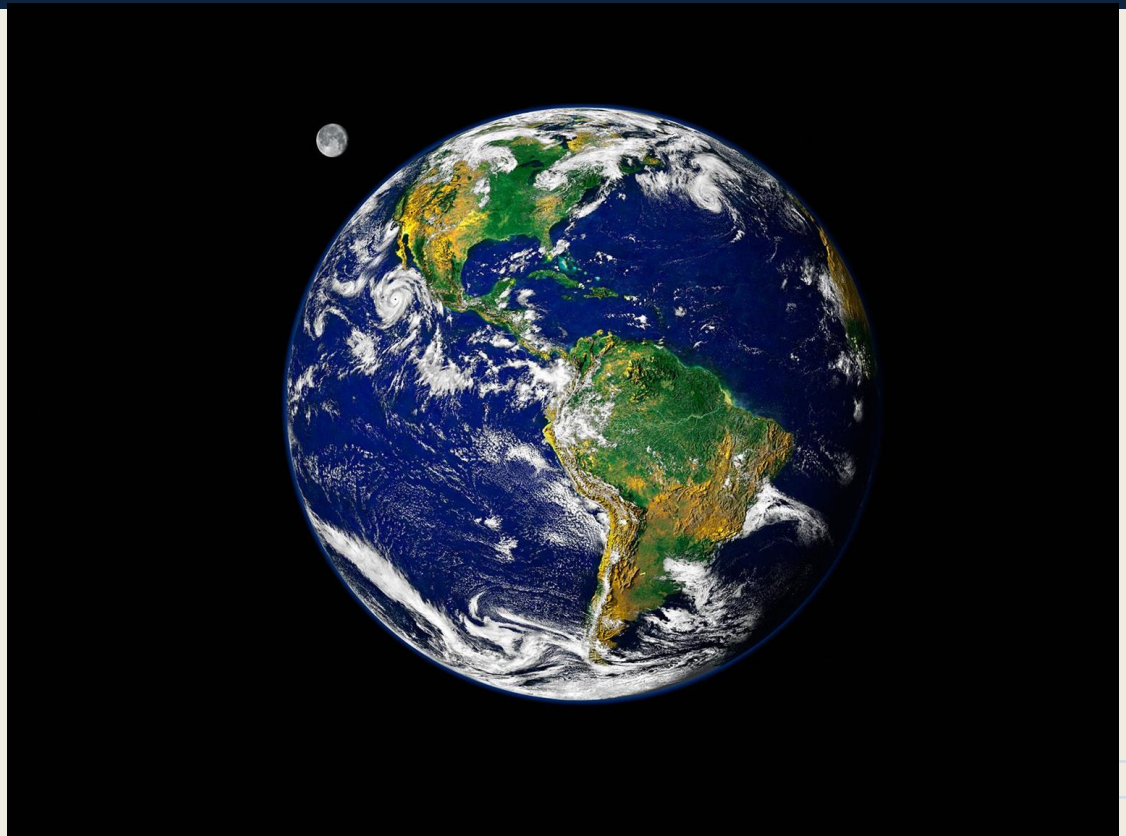


(b)

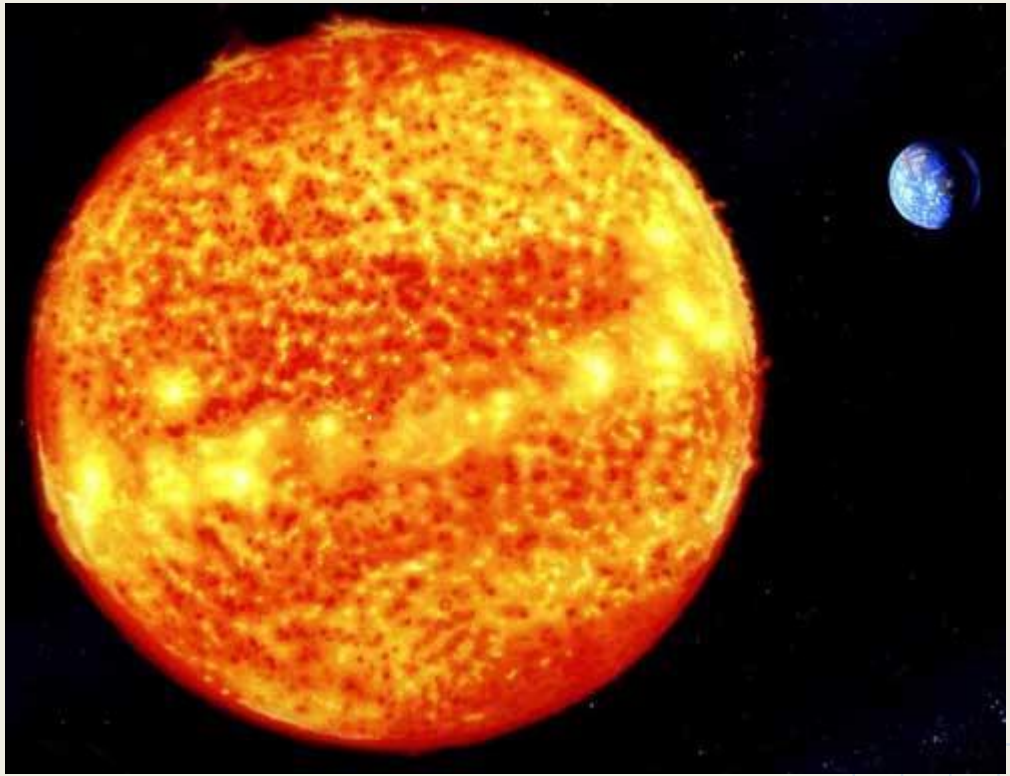
Stop

Relativity

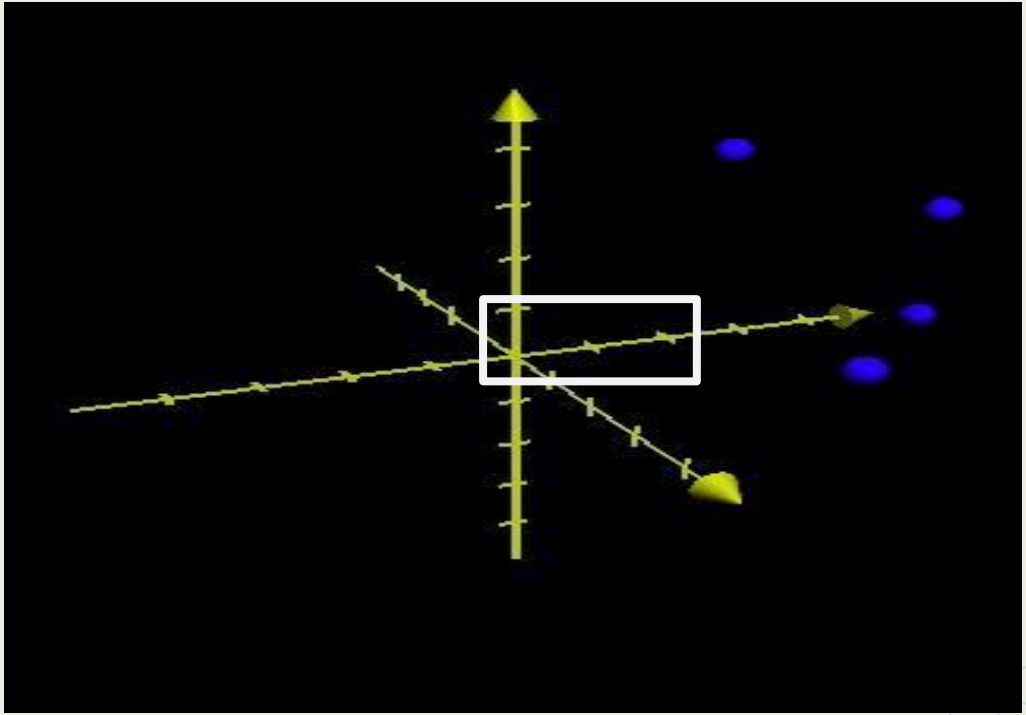
Relativity



Relativity



Computer Graphics



OpenGL Program

```
void init(void)
{
        glClearColor(1.0, 1.0, 1.0, 1.0);
        glViewport(0, 0, 320, 240);
        gluOrtho2D(0.0, 160.0, 0.0, 120.0);
}

int main(int argc, char* argv[])
{
        glutInit(&argc, argv);
        glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
        glutInitWindowSize(320, 240);
        glutCreateWindow("character window");
        init();
        glutDisplayFunc(Display);
        glutMainLoop();
        return 0; }
```

OpenGL is a Library written by C++

```
//APPLE
#include <GLUT/glut.h>
#include <OpenGL/gl.h>

//Windows
#include “stdfax.h”
#include <glut.h>
```

Display Function

```
void Display()
{
        glClear(GL_COLOR_BUFFER_BIT);
    glFlush();
}
```

Draw Point

```
void Display(void)
{
		glClear(GL_COLOR_BUFFER_BIT);

		glColor3f(0.0, 0.0, 0.0);

	glBegin(GL_POINTS);
		{
			glVertex2f(100.0, 100.0);
		}
		glEnd();

		glFlush();
}
```

Draw Line

```
void Display(void)
{
		glClear(GL_COLOR_BUFFER_BIT);

		glColor3f(0.0, 0.0, 0.0);
		glBegin(GL_LINES);
		{
		glVertex2f(100.0, 100.0);
		glVertex2f(0.0, 0.0);
		}
		glEnd();

		glFlush();
}
```

Draw Rectangle

```
void Display(void)
{
        glClear(GL_COLOR_BUFFER_BIT);


        glColor3f(0.0, 0.0, 0.0);

    glRectf(0.0, 0.0, 100.0, 100.0);

        glFlush();
}
```

Draw Polygon

```
void Display(void)
{
	glClear(GL_COLOR_BUFFER_BIT);

	glColor3f(0.0, 0.0, 0.0);
	glBegin(GL_POLYGON);
	{
		glVertex2f(0.0, 0.0);
		glVertex2f(100.0, 0.0);
		glVertex2f(100.0, 100.0);
		glVertex2f(0.0, 100.0);
	}
	glEnd();

	glFlush();
}
```

Draw Circle

```
#include <OpenGL/gl.h>
#include <GLUT/glut.h>
#include <math.h>

#define PI 3.14159
```

Draw Circle

```
void Display(void)
{
        glClear(GL_COLOR_BUFFER_BIT);
        glColor3f(0.0, 0.0, 0.0);

        int number_of_iterations = 100;
        int centerx = 100 , centery = 100;
        int radius = 10;
        glBegin(GL_POLYGON);
        {
        for (int i = 0 ; i < number_of_iterations; ++i)
        {
        double theta = 2 * PI * i / number_of_iterations;
        glVertex2f(centerx + cos(theta) * radius, centery + sin(theta) * radius);
        }}
        glEnd();
        glFlush();
}
```

Answer 3 - a

http://pastebin.com/p38PFKXh

Answer 3 - b

http://pastebin.com/Gbjf7Nyz

Report

http://codeforces.com/problemset/problem/131/A

and

http://codeforces.com/problemset/problem/133/A

and

Draw your home :)

Thanks